

Brain Builders Coaching Center

Class – X ICSE

Chemical coordination in Plants

Chemical coordination in plants is controlled by plant hormones, also called phytohormones, and is different from the nervous system seen in animals. Plants coordinate their functions using chemical messengers as they do not have a nervous system or specialized sense organs.

PLANT HORMONES (PHYTOHORMONES)

Plant hormones are naturally occurring chemical substances produced in minute quantities in plants that regulate growth, development, and physiological processes. They are transported from one part of the plant to another to carry out their function.

1. AUXINS

Auxins are a group of plant hormones that promote cell elongation, especially in shoots, and are involved in apical dominance, root initiation, and tropic movements.

Functions:

- Promotes cell elongation in shoots.
- Helps in phototropism (bending towards light).
- Inhibits growth of lateral buds (apical dominance).
- Stimulates the growth of adventitious roots in stem cuttings.
- Delays fall of leaves and fruits (abscission).

Examples:

- Indole-3-acetic acid (IAA)
- Naphthalene acetic acid (NAA) – synthetic auxin

2. GIBBERELLINS

Gibberellins are a group of plant hormones that promote stem elongation, seed germination, and flowering in some plants.

Functions:

- Stimulate elongation of stems by increasing cell division and elongation.
- Break seed dormancy and promote germination.
- Induce bolting (sudden stem elongation before flowering) in plants like cabbage.
- Promote fruit enlargement (e.g., seedless grapes).

Examples:

- Gibberellic acid (GA₃)

3. CYTOKININS

Cytokinins are hormones that promote cell division (cytokinesis), especially in roots and shoots, and delay aging in leaves.

Functions:

- Stimulate cell division and growth.
- Delay senescence (aging) of leaves.
- Promote lateral bud growth (breaking apical dominance).
- Used in tissue culture to promote shoot formation.

Examples:

- Zeatin (natural)
- Kinetin (synthetic)

4. ABSCISIC ACID (ABA)

Absciscic acid is a growth-inhibiting hormone that plays a major role in stress responses, especially during drought.

Functions:

- Induces dormancy in seeds and buds.
- Causes closure of stomata during water stress.
- Promotes abscission (shedding) of leaves, flowers, and fruits.
- Inhibits growth in general.

Example:

- ABA (natural hormone)

5. ETHYLENE

Ethylene is a gaseous plant hormone responsible for fruit ripening and senescence.

Functions:

- Accelerates ripening of fruits (banana, mango, etc.).
- Promotes abscission of leaves and flowers.
- Stimulates flowering in some plants (e.g., pineapple).
- Causes epinasty (downward bending of leaves).

Example:

- Ethylene gas (natural and simplest hormone)

MOVEMENTS IN PLANTS

Plant movements are responses of plant parts to external or internal stimuli. These movements help the plant adjust to its environment and are classified into two major types based on the nature of the stimulus and direction of response.

TYPES OF MOVEMENTS

I. TROPIC MOVEMENTS

Tropic movements are directional movements of a plant part in response to a stimulus. The direction of the movement is determined by the direction of the stimulus.

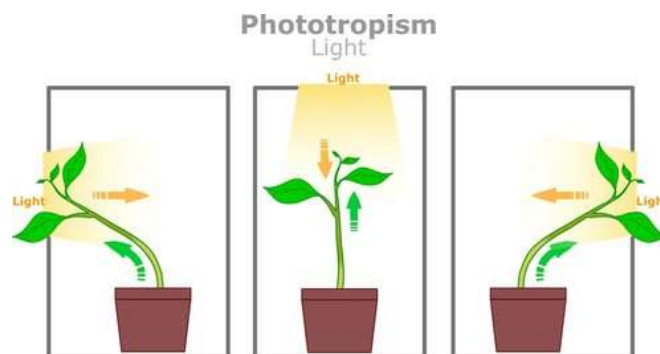
Characteristics:

- Directional
- Irreversible
- Specific to stimuli like light, gravity, water, etc.

Types of Tropic Movements:

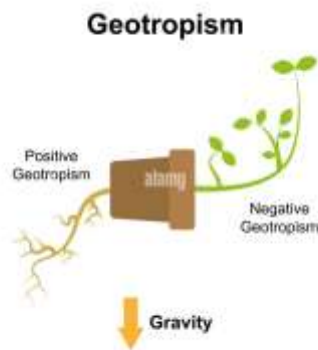
1. Phototropism:

- Movement in response to light.
- Example: Bending of shoot towards light (positive phototropism), root away from light (negative phototropism).



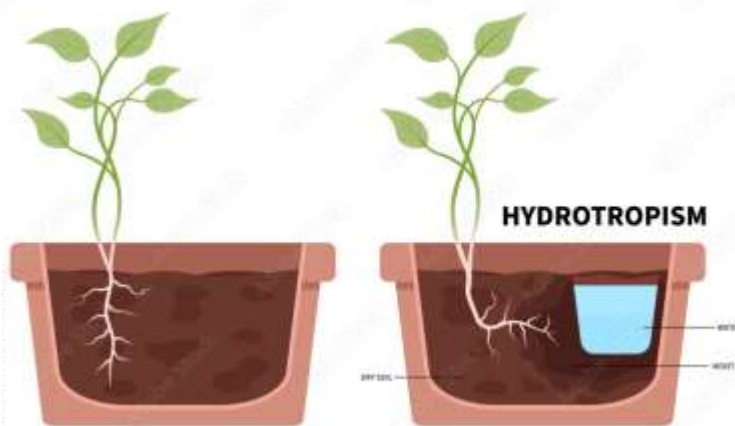
2. Geotropism (Gravitropism):

- Movement in response to gravity.
- Example: Roots grow downwards (positive geotropism), stem grows upwards (negative geotropism).



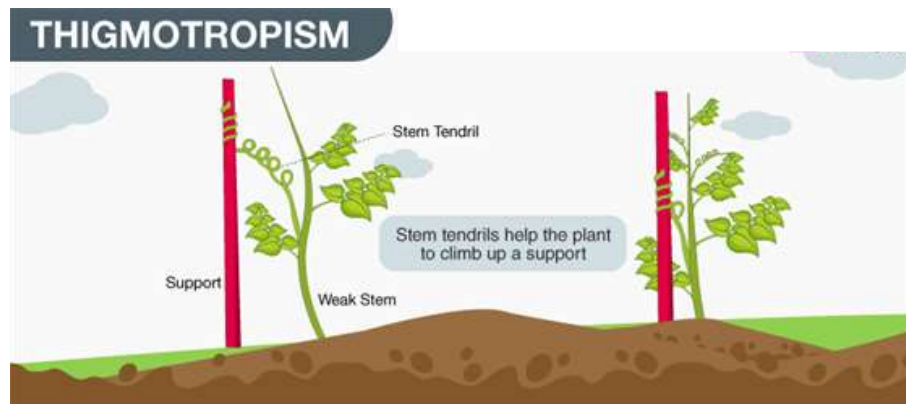
3. Hydrotropism:

- Movement in response to water.
- Example: Root tips grow towards water.



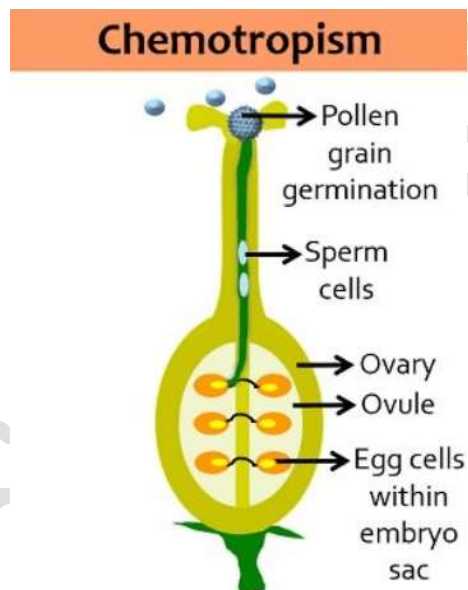
4. Thigmotropism:

- Movement in response to touch/contact.
- Example: Tendrils coil around support.



5. Chemotropism:

- Movement in response to chemical stimuli.
- Example: Pollen tube growing toward ovule due to chemicals released by ovule.



II. NASTIC MOVEMENTS

Nastic movements are non-directional movements in response to stimuli. The direction of the stimulus does not determine the direction of movement.

Characteristics:

- Non-directional
- Reversible
- Based on turgor pressure changes in cells

Types of Nastic Movements:

1. Photonasty:

- Movement in response to light, but direction is not fixed.
- Example: Opening of petals in sunlight and closing in darkness (e.g., dandelion flowers).

2. Thigmonasty (Seismonasty):

- Movement in response to touch or mechanical stimulus.
- Example: Folding of Mimosa pudica (Touch-me-not) leaves when touched.

HORMONES

Hormone	Nature	Functions	Examples
Auxins	Growth-promoting	Cell elongation, apical dominance, root initiation	IAA, NAA
Gibberellins	Growth-promoting	Stem elongation, seed germination, fruit enlargement	GA3
Cytokinins	Growth-promoting	Cell division, delay senescence, lateral bud growth	Zeatin, Kinetin
Absciscic Acid	Growth-inhibiting	Dormancy, stomatal closure, abscission	ABA
Ethylene	Growth-inhibiting	Fruit ripening, abscission, flowering in pineapple, senescence	Ethylene gas

MOVEMENTS

Movement Type	Stimulus	Directional?	Example
Phototropism	Light	Yes	Shoot bends towards light
Geotropism	Gravity	Yes	Roots grow downward
Hydrotropism	Water	Yes	Root bends towards moisture
Thigmotropism	Touch	Yes	Tendrils coil around support
Chemotropism	Chemicals	Yes	Pollen tube grows toward ovule
Photonasty	Light	No	Flower petals open/close with light
Thigmonasty	Touch/Impact	No	Mimosa leaves fold when touched